FORM PTO-1390 (REV 11-2000) U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: MUR-8582US

U S. APPLICATION NO (If known, see 37 CFR 1 5): 10/019070

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/GB00/02290	23 June 2000	23 June 1999

TITLE OF INVENTION
DYED FABRIC MATERIAL, METHOD OF PRODUCING THE SAME AND USE OF THE FABRIC MATERIAL IN THE MANUFACTURE OF SPORTS BALLS

APPLICANT(S) FOR DO/EO/US
Alan John Brasier and David Anthony Smith

Applicant herewith submits to the united States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☐ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☐ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409) with annexed amended claims.

Items 11 to 20 below concern documents(s) or information included:

11. ☒ An Information Disclosure Statement under 37 U.S.C. 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
14. ☐ A SECOND or SUBSEQUENT preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 – 1.825.
18. ☒ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☐ Other items or information:

JC13 Rec'd PCT/PTO 20 DEC 2001

U.S APPLICATION NO (if known, see 37 CFR 1.5) 10/019070	INTERNATIONAL APPLICATION NO. PCT/GB00/02290	ATTORNEY DOCKET NUMBER MUR-8582US

21. ☒ The following fees are submitted:

BASIC NATIONAL FEE (37 CFR 1.492(a)(1) – (5)):

☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO... .... **$1040.00**

☒ International preliminary examination fee (37 CFR 1.482)not paid to USPTO but International Search Report prepared by the EPO or JPO.... ..... **$890.00**

☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$740.00**

☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$710.00**

☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**

CALCULATIONS PTO USE ONLY

				CALCULATIONS	PTO USE ONLY
ENTER APPROPRIATE BASIC FEE AMOUNT =				$ 890.	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 Months from the earliest claimed priority date (37 CFR 1.492(e)).				$	
CLAIMS	NUMBER FILED	EXTRA NUMBER	RATE		
Total claims	49- 20 =	29	X $18.00	$ 522.	
Independent claims	3 - 3 =	0	X $84.00	$ 0.	
MULTIPLE DEPENDENT CLAIM(S) (if applicable) ☐			+ $280.00	$ 0.	
TOTAL OF ABOVE CALCULATIONS =				$ 1412.	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by ½.				$	
SUBTOTAL =				$ 1412.	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 Months from the earliest claimed priority date (37 CFR 1.492(f)). +				$	
TOTAL NATIONAL FEE =				$ 1412.	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$ 40.	
TOTAL FEES ENCLOSED =				$ 1452.	
				Amount to be refunded:	$
				Charged:	$

a. ☒ Two checks in the amounts of $1412 and $40 to cover the above fees are enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 18-0350. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING**: Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:
Allan Ratner
Ratner & Prestia
Suite 301
One Westlakes, Berwyn
P.O. Box 980
Valley Forge, PA 19482-0980
(610) 407-0700

SIGNATURE

Allan Ratner
NAME

19,717
REGISTRATION NUMBER

December 20, 2001
DATE

MUR-8582US PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Alan John Brasier and David Anthony Smith	: Interntl Appli. No.: PCT/GB00/02290
Serial No.:	(to be assigned)	: Interntl Filing Date:
Filed:	(herewith)	: 23 June 2000
FOR:	DYED FABRIC MATERIAL, METHOD OF PRODUCING THE SAME AND USE OF THE FABRIC MATERIAL IN THE MANUFACTURE OF SPORTS BALLS	:

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

S I R :

Preliminary to examination in the United States Patent and Trademark Office, please make the following amendments in the above-identified application in order to place it in condition for examination.

IN THE SPECIFICATION:

Amend the specification by inserting before the first line the sentence:

This application is the U.S. national phase application of PCT International Application No. PCT/GB00/02290 filed 23 June 2000.

IN THE CLAIMS:

Please replace claims 3-5, 8-15, 17, 20-24, 29-31, 34-38, 41-46 and 48 with the following amended claims:

3. (Amended) The method as claimed in Claim 1, wherein said yellow dye has a colour index number acid yellow 250.

4. (Amended) The method as claimed in Claim 1, wherein said material is made from a mixture of fibres of different types.

5. (Amended) The method as claimed in Claim 1, wherein said material comprises a mixture of wool and synthetic fibres.

8. (Amended) The method as claimed in Claim 1, wherein the content of wool fibres in said material is at least 20% by weight.

9. (Amended) The method as claimed in Claim 1, wherein the content of wool fibres in said material is at least 25% by weight.

10. (Amended) The method as claimed in Claim 1, wherein the content of wool fibres in said material is at least 40% by weight.

11. (Amended) The method as claimed in Claim 1, wherein said weft yarns comprise at least 20% by weight of wool.

12. (Amended) The method as claimed in Claim 1, wherein said weft yarns comprise at least 30% by weight of wool.

13. (Amended) The method as claimed in Claim 1, wherein said weft yarns comprise at least 40% by weight of wool.

14. (Amended) The method as claimed in Claim 1, wherein said material is processed in piece form.

15. (Amended) The method as claimed in Claim 1, wherein said material is contacted with a partitioning agent.

17. (Amended) The method as claimed in Claim 1, wherein said material is treated using a jet-dyeing apparatus.

20. (Amended) The method as claimed in Claim 1, wherein said material is contacted with the bleaching agent prior to said material being contacted with said fluorescent dye.

21. (Amended) The method as claimed in Claim 15, wherein said material is contacted with the partitioning agent prior to said material being contacted with said fluorescent dye.

22. (Amended) The method as claimed in Claim 15, wherein said bleaching agent is added simultaneously or quasi-simultaneously with the partitioning agent.

23. (Amended) The method as claimed in Claim 1, wherein said bleaching agent is an inorganic reducing agent with chelating agents and comprises 30-40% by weight tetrasodium ethylene-diaminetetraacetate and 30-40% by weight disodium disulphite.

24. (Amended) A coloured fabric material obtainable according to the method described in Claim 1.

29. (Amended) The fabric material as claimed in Claim 27, wherein said lightness value is 96 or more.

30. (Amended) The fabric material as claimed in Claim 27, wherein said reflectance value is 125 or more.

31. (Amended) The fabric material as claimed in Claim 27, which exhibits the following characteristics:

i) a chroma value of 110 or more;

ii) a lightness value of 97 or more; and

iii) a reflectance value of 128 or more.

34. (Amended) A white fabric material as claimed in Claim 32, having a lightness value of 92 or greater.

35. (Amended) A white fabric material as claimed in Claim 32, having a reflectance value of 85 or more.

36. (Amended) A white fabric material as claimed in Claim 32, which exhibits the following characteristics:

i) a chroma value of 5 or less;

ii) a lightness value of 93 or more; and

iii) a reflectance value of 90 or more.

37. (Amended) A fabric material as claimed in Claim 27, wherein said material is made of a mixture of fibres of different types.

38. (Amended) A fabric material as claimed in Claim 27, wherein said material comprises a mixture of wool and synthetic fibres.

41. (Amended) A fabric material as claimed in Claim 27, wherein the content of wool fibres in said material is at least 20% by weight.

42. (Amended) A fabric material as claimed in Claim 27, wherein the content of wool fibres in said material is at least 40% by weight.

43. (Amended) A fabric material as claimed in Claim 27, wherein said weft yarns comprise at least 20% by weight of wool.

44. (Amended) A fabric material as claimed in Claim 27, wherein said weft yarns comprise at least 30% by weight of wool.

45. (Amended) A fabric material as claimed in Claim 27, wherein said weft yarns comprise at least 40% by weight of wool.

46. (Amended) A sports ball having a fabric material outer surface, said fabric material being a fabric material as defined in Claim 27.

48. (Amended) A sports ball having a fabric material outer surface, said fabric material being a fabric material as obtained by the method of Claim 1.

IN THE ABSTRACT:

Please include an Abstract on a separate sheet as enclosed herewith.

Respectfully submitted,

Allan Ratner, Reg. No. 19,717
Attorney for Applicant

AR/lk

Dated: December 20, 2001

P.O. Box 980
Valley Forge, PA 19482
(610) 407-0700

The Assistant Commissioner for Patents is hereby authorized to charge payment to Deposit Account No. **18-0350** of any fees associated with this communication.

EXPRESS MAIL Mailing Label Number: **EL 923264464 US**
Date of Deposit: **December 20, 2001**

I hereby certify that this paper and fee are being deposited, under 37 C.F.R. § 1.10 and with sufficient postage, using the "Express Mail Post Office to Addressee" service of the United States Postal Service on the date indicated above and that the deposit is addressed to the Assistant Commissioner for Patents, U.S. Patent & Trademark Office, Washington, D.C. 20231, Attn: BOX PCT/EO/US.

Kathleen Libby

ABSTRACT

A method of dyeing fabric material which comprises the step of contacting said fabric material with a bleaching agent prior to or simultaneously with contacting said fabric material with a dyestuff providing said colour. The fabric material so obtained is suitable for use in sports ball manufacture, especially tennis ball manufacture. The coloured fabric material preferably includes wool fibres and exhibits the following characteristics after dyeing: i) a chroma value of 100 or more; ii) a lightness value of 95 or more; and iii) a reflectance value of 120 or more. Preferably the dye is a yellow fluorescent dye.

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Specification at page 1, line 1:

This application is the U.S. national phase application of PCT International Application No. PCT/GB00/02290 filed 23 June 2000.

IN THE CLAIMS:

3. (Amended) The method as claimed in ~~either Claim 1 or 2~~ Claim 1, wherein said yellow dye has a colour index number acid yellow 250.

4. (Amended) The method as claimed in ~~any one of Claims 1 to 3~~ Claim 1, wherein said material is made from a mixture of fibres of different types.

5. (Amended) The method as claimed in ~~any one of Claims 1 to 4~~ Claim 1, wherein said material comprises a mixture of wool and synthetic fibres.

8. (Amended) The method as claimed in ~~any one of Claims 1 to 7~~ Claim 1, wherein the content of wool fibres in said material is at least 20% by weight.

9. (Amended) The method as claimed in ~~any one of Claims 1 to 8~~ Claim 1, wherein the content of wool fibres in said material is at least 25% by weight.

10. (Amended) The method as claimed in ~~any one of Claims 1 to 9~~ Claim 1, wherein the content of wool fibres in said material is at least 40% by weight.

11. (Amended) The method as claimed in ~~any one of Claims 1 to 10~~ Claim 1, wherein said weft yarns comprise at least 20% by weight of wool.

12. (Amended) The method as claimed in ~~any one of Claims 1 to 10~~ Claim 1, wherein said weft yarns comprise at least 30% by weight of wool.

13. (Amended) The method as claimed in ~~any one of Claims 1 to 10~~ Claim 1, wherein said weft yarns comprise at least 40% by weight of wool.

14. (Amended) The method as claimed in ~~any one of Claims 1 to 13~~ Claim 1, wherein said material is processed in piece form.

15. (Amended) The method as claimed in ~~any one of Claims 1 to 14~~ Claim 1, wherein said material is contacted with a partitioning agent.

17. (Amended) The method as claimed in ~~any one of Claims 1 to 16~~ Claim 1, wherein said material is treated using a jet-dyeing apparatus.

20. (Amended) The method as claimed in ~~any one of Claims 1 to 19~~ Claim 1, wherein said material is contacted with the bleaching agent prior to said material being contacted with said fluorescent dye.

21. (Amended) The method as claimed in ~~any one of Claims 15 to 16~~ Claim 15, wherein said material is contacted with the partitioning agent prior to said material being contacted with said fluorescent dye.

22. (Amended) The method as claimed in ~~any one of Claims 15, 16 and 18~~ Claim 15, wherein said bleaching agent is added simultaneously or quasi-simultaneously with the partitioning agent.

23. (Amended) The method as claimed in ~~any one of Claims 1 to 22~~ Claim 1, wherein said bleaching agent is an inorganic reducing agent with chelating agents and comprises 30-40% by weight tetrasodium ethylene-diaminetetraacetate and 30-40% by weight disodium disulphite.

24. (Amended) A coloured fabric material obtainable according to the method described in ~~any one of Claims 1 to 23~~ Claim 1.

29. (Amended) The fabric material as claimed in ~~either one of Claims 27 and 28~~ Claim 27, wherein said lightness value is 96 or more.

30. (Amended) The fabric material as claimed in ~~any one of Claims 27 to 29~~ Claim 27, wherein said reflectance value is 125 or more.

31. (Amended) The fabric material as claimed in ~~any one of Claims 27 to 29~~ Claim 27, which exhibits the following characteristics:

i) a chroma value of 110 or more;

ii) a lightness value of 97 or more; and

iii) a reflectance value of 128 or more.

34. (Amended) A white fabric material as claimed in ~~either one of Claims 32 and 33~~ Claim 32, having a lightness value of 92 or greater.

35. (Amended) A white fabric material as claimed in ~~any one of Claims 32 to 34~~ Claim 32, having a reflectance value of 85 or more.

36. (Amended) A white fabric material as claimed in ~~any one of claims 32 to 35~~ Claim 32, which exhibits the following characteristics:

i) a chroma value of 5 or less;

ii) a lightness value of 93 or more; and

iii) a reflectance value of 90 or more.

37. (Amended) A fabric material as claimed in ~~any one of Claims 27 to 36~~ Claim 27, wherein said material is made of a mixture of fibres of different types.

38. (Amended) A fabric material as claimed in ~~any one of Claims 27 to 37~~ Claim 27, wherein said material comprises a mixture of wool and synthetic fibres.

41. (Amended) A fabric material as claimed in ~~any one of Claims 27 to 44~~ Claim 27, wherein the content of wool fibres in said material is at least 20% by weight.

42. (Amended) A fabric material as claimed in ~~any one of Claims 27 to 41~~ Claim 27, wherein the content of wool fibres in said material is at least 40% by weight.

43. (Amended) A fabric material as claimed in ~~any one of Claims 27 to 42~~ Claim 27, wherein said weft yarns comprise at least 20% by weight of wool.

44. (Amended) A fabric material as claimed in ~~any one of Claims 27 to 43~~ Claim 27, wherein said weft yarns comprise at least 30% by weight of wool.

45. (Amended) A fabric material as claimed in ~~any one of Claims 27 to 44~~ Claim 27, wherein said weft yarns comprise at least 40% by weight of wool.

46. (Amended) A sports ball having a fabric material outer surface, said fabric material being a fabric material as defined in ~~any one of Claims 27 to 45~~ Claim 27.

48. (Amended) A sports ball having a fabric material outer surface, said fabric material being a fabric material as obtained by the method of ~~any one of Claims 1 to 24~~ Claim 1.

DYED FABRIC MATERIAL, METHOD OF PRODUCING THE SAME AND USE OF THE FABRIC MATERIAL IN THE MANUFACTURE OF SPORTS BALLS

The present invention relates to fabric material particularly suitable for the manufacture of sports balls and to a method of obtaining the same. More particularly it relates to a new method of dyeing woven or not woven material which provides the material with high visibility characteristics. The invention also relates to the dyed material thus obtained and to the use of such material for the manufacture of sports products and particularly for the covering of tennis balls.

Traditionally, tennis balls were covered with white woollen felt. Several decades ago yellow felt was introduced for use on match quality balls and from the early 1970's balls covered with yellow felt became increasingly popular. Today, the vast

majority of tennis balls are covered with yellow felt. Rule 3 of the International Tennis Federation Rules of Tennis states "The ball shall have a uniform outer surface consisting of a fabric cover and shall be white or yellow in colour...".

The felt used on tennis balls was previously made from wool. Increased wear properties are obtained by including a proportion of synthetic fibres in the felt, and nowadays such felt is usually made of a mixture of wool and nylon fibres. The proportions of wool and synthetic fibres used to produce the felt can vary, but typically a ratio of 40:60 to 60:40 can be used (by weight of weft yarn). It is desirable that the side of the felt termed the "back" (which is the side which will be stuck to the ball) is made of a material which provides good adhesion when it is glued on the internal rubber sphere of the ball. Usually the backing is formed by using 100% cotton warp yarns, but alternatives such as polyester and nylon could be used.

The tennis ball felt is then preferably dyed with a fluorescent dyestuff. That is, the coloured felt will absorb ultra-violet light and re-emit the absorbed energy in the visible area of the spectrum. Most tennis balls are now covered with felt that is dyed fluorescent yellow and which produces peak reflectance values of over 100% in the yellow area of the spectrum.

Few manufacturers produce fluorescent dyestuffs suitable for both wool and polyamide fibres. To the best of the Applicant's knowledge all the major tennis ball felt manufacturers use the same class of dyestuff albeit from different dyestuff suppliers. This class of dyestuff gives a hue (colour) slightly to the green side of yellow.

The cones in the human eye are mainly responsible for daylight colour vision and these give the eye the highest visual efficiency in the yellow wavelengths. In addition to percentage reflectance three other values can be plotted to identify a colour:

Lightness, with a scale of 0 to 100, 0 being black and 100 white;

Hue, which can be shown as a circle with red at 0 degrees and yellow, green and blue at 90 degree intervals from this, the exact angle therefore indicating the hue. If the lightness is visualised as a vertical axis passing through the centre of the hue circle, then a colour can be plotted in three dimensional space; and

Chroma or colour saturation which can be shown as the distance along a given radius from the centre of the hue circle.

In the mid 1990's a high visibility yellow felt (or Hi.Viz. F/Y) was produced using an increased

percentage of dyestuff. This felt (or Hi.Viz. F/Y) has a higher level of saturation (chroma) but actually has a slight reduction in peak reflectance and in lightness when compared to some standard coloured felt.

A method has now been found which allows the production of coloured felt for tennis balls having enhanced visibility properties over the prior art.

The invention also provides a method of dyeing material which produces an Ultra High Visibility (UHV) felt which mitigates shortfalls of previously available dyed felts.

More particularly, the invention provides a method of dyeing fabric material (particularly fabric material which is suitable for use in sports ball manufacture) which method comprises contacting said fabric material with a bleaching agent prior to or simultaneously with contacting said fabric material with a dyestuff providing said colour. The term "fabric material" includes both piece goods, yarns and also fibres in loose form.

The present invention is based on the fact that the felt used to produce tennis balls typically has a significant wool content (usually 40% or higher). However, the peak reflectance of natural wool fibre in the yellow area of the spectrum is typically around 75% due to the natural yellowish-tinge in even

the whitest wool. By means of comparison, titanium dioxide treated nylon would typically have a 90% reflectance. We have found that the naturally low reflectance of wool limits the reflectance achievable even with a fluorescent dye.

The need to bleach a yellowish-fibre (natural wool) prior to or during dyeing that fibre yellow appears counter-intuitive, but we have found that the performance of the dye applied is greatly enhanced by this step.

Preferably the material to be dyed is a felt and especially a woven felt.

Preferably the material to be dyed comprises a mixture of fibres of different types, for example, a mixture of wool and synthetic (e.g. polyamide or polyester) fibres. Preferred synthetic fibres are polyamide fibres, for example Nylon 6,6 or Nylon 6. We have found Nylon 6,6 to be most suitable. One or more different synthetic fibres may be present in the fabrics material.

The proportions of wool and synthetic fibres may vary according to the consumer's requirements on cost and performance of the fabric material. For woven fabrics having warp and weft yarns, a wool content of at least 20% (usually 25%) by weight of weft yarn is required.

We have found that better quality fabric material is achieved with increased wool content - for example 30% or higher by weight of weft yarn. Typically a wool content of 40% or above, for example 50% or 60%, by weight of weft yarn achieves good results. It may be desirable to use fabric having a wool content of over 45% by weight of weft yarn and in certain high quality fabric materials, like those used for high quality tennis balls, over 50% (usually around 60%) is used. In some cases the wool content may be even higher (e.g. over 65% or 70% by weight of weft yarn) and be 80% or over.

For woven fabric, the warp yarn will typically be a cotton yarn, but polyester or polyamide (e.g. nylon) could alternatively be used. For non-woven fabrics (e.g. needlefelted fabrics) or knitted fabrics a lower wool content (for example in the range of 20-40% by weight, preferably at least 25%) may be sufficient. By "wool" we include wool-like fibres (e.g. angora, cashmere and mohair) as well as the more typical sheep's wool.

Nylon fibres having a circular cross-section have been successfully used, but synthetic fibres having other cross-sections (e.g. triangular or flattened) are commercially available and may further increase the reflectance achievable.

It is also preferred that the material is processed as described in piece form. Preferably the fabric is

a felt and more particularly a felt suitable for the covering of tennis balls. Since a mixture of fibre types (wool and synthetic) are present in the fabric material, it is recommended to contact the fabric material also with a partitioning agent in order to eliminate or reduce the difference in uptake of the dyestuff between the different types of fibres. The bleaching agent, which is preferably a reduction bleaching agent, whitens the initial colour of at least the wool.

Preferably the fabric material is treated using a jet-dyeing apparatus and a liquor ratio of 6:1 to 8:1 is used to run the machine.

It is further preferred that the pH is adjusted preferably between 4.2 and 4.5 by using, for example, formic acid. The temperature is then raised to a suitable temperature, for example about 45°C, and held for a period of, typically, 3 minutes to be able to check and if necessary adjust the pH.

A wide range of suitable partitioning agents are available depending for example upon the nature of the material to be treated. However the partitioning agent sold under the Trade Name BASOPAL NA by BASF plc of Cheshire, SK8 6QG, United Kingdom, has demonstrated good results. BASOPAL NA is an alkylarylsulphonate in water and comprises 50-60% by weight of the salt of dodecylbenzenesulphonic and triethanolamine. The concentration of BASOPAL NA

recommended is about 0.5 grams per litre of liquor. Alternative partitioning agents include THIOTAN RMFN LIQUID (an anionic sulphated fatty acid, pH 7 to 8 at 10% dilution) to be used at a concentration of 3.0 to 0.1% (o.w.f.); and ERIONAL RF of Ciba Speciality Chemicals Inc, Basel, Switzerland (an anionic condensation product of aromatic sulphonic acids and formaldehyde, pH 3.5 at 5% solution) to be used at a concentration of 0.5 to 6% gram per litre liquor.

It is further preferred that the bleaching agent and, if appropriate, the partitioning agent be in contact with the material for a reasonable length of time (typically from 1 to 30 mins) prior to the dyeing step being executed.

It is further preferred that the bleaching agent be added simultaneously or quasi-simultaneously with the partitioning agent.

The bleaching agent preferably used is the one sold under the Trade Name LUFIBROL FW by BASF plc of Cheshire, SK8 6QG, United Kingdom. LUFIBROL FW is an inorganic reducing agent with chelating agents and comprises 30-40% by weight tetrasodium ethylene-diaminetetraacetate and 30-40% by weight disodium disulphite. The amount of LUBRIFOL FW used is advantageously about 2% of the weight of fibre. Alternative bleaching agents include LANALBIN BE powder (a non-ionic hydroxylamine derivative, pH 5.6-5.7 at 1 g/litre) to be used at a concentration of

1.0 to 4.0% (o.w.f.); and ERIOCLARITE B of Ciba Speciality Chemicals Inc of Basle, Switzerland (an anionic mixture of sodium metabisulphite with the sodium salt of ethylenediamine tetraacetic acid, pH 6 at 5% solution) to be used at a concentration of 0.5 to 1 g/litre.

It is preferred to use a fluorescent dye.
It is further preferred to use a yellow dye, as this colour is highly desirable for the manufacture of tennis balls. The preferred yellow dye which can be used according to the invention is a dye having a colour index number acid yellow 250, for example the one sold under the Trade Name NYLOMINE FLAVINE C-7G dyestuff by BASF plc, of Cheshire, SK8 6QG, United Kingdom. The dyeing step can be performed according to the recommended practice. A typical method is to add the dyestuff to the material and the liquor according to a recommended concentration and the temperature is then raised to the recommended level and held for some time at this temperature before rinsing.

The method of the invention also provides a white fabric material having enhanced visibility properties. The method is similar to that described above except that the "dyestuff" referred to is an optical brightening agent. Optical brightening agents are commonly used in the dyeing industry. The brightening agent sold under the trade name UVITEX

NFB by Ciba Speciality Chemicals Inc of Basle, Switzerland can advantageously be used.

The invention also relates to the dyed material, preferably a felt, and more preferably a woven felt, obtained according to the method of the invention which is coloured, preferably in yellow, and displays enhanced visibility properties.

The invention further relates to the use of coloured fabric material dyed according to the method of the invention in the manufacture of articles such as sporting articles and more particularly tennis balls.

The invention further relates to sporting articles comprising the dyed fabric material, and more particularly to sports balls (in particular tennis balls) covered with such material.

The present invention provides a fabric material suitable for use in sports ball manufacture, wherein said material includes wool fibres and exhibits the following characteristics:

a) for a coloured (non-white) fabric material:

i) a chroma value of 100 or more;
ii) a lightness value of 95 or more; and
iii) a reflectance value of 120 or more, or

b) for a white fabric material:

i) a chroma value of 14 or less;

ii) a lightness value of 85 or more; and

iii) a reflectance value of 100 or more.

When the dyed material is a woven fabric having warp and weft yarns, a wool content of at least 20% (usually 25%) by weight of weft yarn is required. Desirably, the wool content includes at least 30% or more, preferably 40% or more, by weight of weft yarn. It may be desirable to use fabric having a wool content of over 45% by weight of weft yarn and in certain high quality fabric materials, like those used for high quality tennis balls, over 50% (usually around 60%) is used. In some cases the wool content may be even higher (e.g. 65% or 70% by weight of weft yarn) and be 80% or over.

For non-woven fabric the minimum amount of wool required is about 20% by weight. Desirably, the wool content includes at least 30% or more, preferably 40% or more, by weight. It may be desirable to use over 45% by weight of wool and in certain high quality fabric materials 50% by weight of wool, or even 60% by weight of wool (e.g. 65% by weight of wool or even up to 70% by weight of wool) may be employed.

For a coloured (non-white) fabric material the chroma value may be higher than 100 (for example 102 or more, preferably 105 or more) and, generally, a high chroma value is desirable provided that the minimum lightness and reflectance values given above for a

coloured (non-white) fabric material are maintained. We have achieved a chroma value of over 110, specifically a value of 113.4.

Likewise, for a coloured (non-white) fabric material a lightness value of greater than 95 is desirable (for example of 96 or more, or even 97 or more) provided that the minimum chroma and reflectance values given above for a coloured (non-white) fabric material are also maintained.

Similarly, for a coloured (non-white) fabric material a reflectance value of over 120 (for example 125 or more, preferably 128 or more) is desirable provided that the minimum lightness and chroma values given above for a coloured (non-white) fabric material are also maintained. We have achieved a reflectance value of over 129, specifically a value of 129.9.

In a preferred embodiment, the coloured (non-white) fabric material according to the present invention exhibits the following characteristics:

i) a chroma value of 105 or more (preferably 110 or more);

ii) a lightness value of 96 or more (preferably 97 or more); and

iii) a reflectance value of 125 or more (preferably 128 or more).

Preferably the coloured (non-white) fabric material is a yellow material.

For a white fabric material, the chroma value is desirably lower than 10 (for example is 8 or less, preferably is 5 or less) and, generally, a low chroma value (indicating absence of colour) is desirable provided that the minimum lightness and reflectance values given above for a white fabric material are maintained.

Likewise, for a white fabric material a lightness value of greater than 85 is desirable (for example of 88 or more, 89 or more, or 90 or more) provided that the maximum chroma value and minimum reflectance value given above for a white fabric material are maintained.

Similarly, for a white fabric material, a reflectance value of over 100 (for example 102 or more, 105 or more or 106 or more) is desirable provided that the maximum chroma value and minimum reflectance value given above for a white fabric material are maintained.

In a preferred embodiment, the white fabric material according to the present invention exhibits the following characteristics:

i) a chroma value of 8 or less (preferably 5 or less);

ii) a lightness value of 92 or more (preferably 93 or more); and

iii) a reflectance value of 85 or more (preferably 90 or more).

The present invention further provides a sports ball having a fabric material surface (for example a tennis ball) wherein said sports ball is manufactured using a fabric material as defined above.

In a further aspect, the present invention provides a sports ball having a fabric material outer surface (for example a tennis ball) wherein said fabric material forming said outer surface includes wool fibres and exhibits the chroma, lightness and reflectance value described above.

In a further aspect, the present invention provides a sports ball having a white fabric material outer surface (for example a tennis ball) wherein said fabric material forming said outer surface includes wool fibres and exhibits the following characteristics :

i) a chroma value of 10 or less;
ii) a lightness value of 90 or more; and
iii) a reflectance value of 80 or more.

When the dyed material is a woven fabric having warp and weft yarns, a wool content of at least 20% (usually 25%) by weight of weft yarn is required. Desirably, the wool content is at least 30% or more, preferably 40% or more, by weight of weft yarn. It

may be desirable to use fabric having a wool content of over 45% by weight of weft yarn and in certain high quality fabric materials, like those used for high quality tennis balls, over 50% (usually around 60%) is used. In some cases the wool content may be even higher (e.g. over 65% or 70% by weight of weft yarn) and be 80% or over.

For non-woven fabric the minimum amount of wool required is about 20% by weight. Desirably, the wool content includes at least 30% or more, preferably 40% or more, by weight. It may be desirable to use over 45% by weight of wool and in certain high quality fabric materials 50% by weight of wool, or even 60% by weight of wool (e.g. 65% by weight of wool or even up to 70% by weight of wool) may be employed.

For a white fabric material, the chroma value is desirably lower than 10 (for example is 8 or less, preferably is 5 or less) and, generally, a low chroma value (indicating absence of colour) is desirable provided that the minimum lightness and reflectance values given above for a white fabric material are maintained.

Likewise, for a white fabric material a lightness value of greater than 90 is desirable (for example of 92 or more, 93 or more, or 94 or more) provided that the maximum chroma value and minimum reflectance value given above for a white fabric material are maintained.

Similarly, for a white fabric material, a reflectance value of over 80 (for example 85 or more, 90 or more or 95 or more) is desirable provided that the maximum chroma value and minimum reflectance value given above for a white fabric material are maintained.

In a preferred embodiment, the white fabric material according to the present invention exhibits the following characteristics:

i) a chroma value of 8 or less (preferably 5 or less);
ii) a lightness value of 92 or more (preferably 93 or more); and
iii) a reflectance value of 85 or more (preferably 90 or more).

The invention as described above with reference to coloured (non-white) fabric material (both in respect of the fabric material per se and in respect of the sports ball having a fabric material outer surface) preferably refers to a yellow fabric material. References to "yellow" refer to any non-white fabric material which is acceptable to the International Tennis Federation (I.T.F.) (since yellow is an accepted coloration of tennis ball according to the I.T.F.). However, this is not exclusive, and other coloured fabric materials (for example pink, green, blue, etc) are also encompassed.

The present invention will be now further described with reference to the following, non-limiting example and Figures in which:

Figure 1 shows the reflectance curves of two prior art felts in ball form (Nos 2 & 3) compared with the Ultra High Visibility yellow felt (UHV F/Y) in fabric form (No 1) of the invention.

Figure 2 shows the reflectance curves of two other felts (Nos 4 & 5) produced by the Applicant and compared with the UHV F/Y felt (No 1) of the invention, all in fabric form.

Figure 3 shows the same data as Figure 2 but the data used to produce the curves are generated by the International Tennis Federation on their spectrophotometer.

Figure 4 shows the saturation (chroma) of the UHV F/Y felt (No 1) of the invention compared with the four prior art felts (Nos 2 to 5) used in Figures 1 to 3.

Figure 5 shows the lightness of the same five felts used in Figure 4.

Figure 6 is an attempt to illustrate the position on the colour circle by both chroma and hue of the five samples used in the comparative data shown in Figures 1 to 5.

Example 1

Production of an ultra high visibility yellow felt according to the method of the invention

The felt used in this example is a fabric material having an back surface made mainly in cotton and a face side made of a wool and polyamide fibre felt (the face side of the fabric forms the external face of the ball). Only the face surface made of wool and polyamide felt needs to be coloured. Wool and polyamide are present in the weft in a ratio of about 60:40 with respect to the weight of wool and polyamide fibres. The amount of cotton fibres in the material represents about 15 % of the total weight of the fabric material.

The felt is dyed using acid dyes in piece form using a Softflow jet dyeing machine which is run at a liquor ratio of between 6:1 and 8:1. The liquor is the liquid in which the material is wetted before the addition of the dyestuff. In most cases and in particular in this example the liquor is water.

The dyeing method used in this example is as follows:-

- The felt is entered into the machine cold and the liquor ratio as indicated above;
- The pH is adjusted between 4.2 and 4.5 with formic acid;
- The temperature is raised to 45°C and held for 3 minutes whilst checking pH;

- 0.5 grams per litre of BASOPAL NA (BASF) and 2% by weight of fibre of Lufibrol FW (BASF) are added through the dosing system; and
- the machine is run for 5 minutes at 45°C.

The following dyeing method is then applied:

- 1.6% by weight of fibres of NYLOMINE FLAVINE C-7G dyestuff is added through the dosing system during a period of 2 minutes;
- the temperature is raised at a rate of 1.8°C per minute to 95°C and the machine is run for 30 minutes at this temperature;
- the temperature is decreased to 40°C at a rate of 2.5°C per minute; and
- the felt is rinsed twice with fresh water and unloaded from the machine.

Comparative data

The colour characteristics of the felt dyed according to the above described method are shown in Figures 1 to 6. Except for Figure 3, all data were measured by the Applicant using CIE (Commission Internationale d'Eclairage) CIELAB formula at a 10 degree reflectance angle using standard D65 illuminant.

Figure 1 shows reflectance curves of an UHV yellow felt (UHV F/Y) made according the method described in Example 1 and of two competing felts in the form of tennis balls produced respectively for the companies Tretorn Sport and Penn Racquet Sports under the Trade Names TRETORN TXT and PRO PENN. The felts used to

cover these balls are produced by Textech Industries. We have found only minimal difference in the spectrophotometric measurements made between a fabric in sheet form and the same fabric when in the form of completed tennis balls.

Figure 2 shows reflectance curves of the UHV F/Y felt used in Figure 1 and of two other yellow felts, a "standard" (Std.F/Y) one and an "high visibility" one (Hi. Viz. F/Y), both produced by the company Milliken (Woollen Speciality Products) under the respective Trade Names PLAYNE'S 14 and PLAYNE'S 45. These felts are used in the manufacture of tennis balls such as the ones sold under the Trade Names DUNLOP FORT (standard) and SLAZENGER WIMBLEDON (high visibility).

Figure 3 shows the same data as Figure 2 but the data used to produce the curves are generated by the International Tennis Federation (ITF) on their spectrophotometer. This independent measurement shows good correlation with the Applicant's own data.

Figures 4 and 5 show respectively the chroma and the lightness of the five tested felts.

Figure 6 shows a graph displaying the combination of both chroma and hue performances of the five tested felts.

As can be seen from Figures 1 to 6, the colour of the felt of this example of the invention demonstrates

superior characteristics in all areas (i.e. chroma, hue lightness and reflectance). The performances, when compared to the closest prior art (i.e. the High Visibility felt manufactured by Milliken), are especially better for lightness and reflectance.

Figures 2 to 4 & 5 show that the high visibility felt has a higher level of saturation (chroma) but actually has a slight reduction in peak reflectance and in lightness when compared to the standard colour felt. This disadvantage does not exist with the colour of the UHV felt.

A summary table of the peak reflectance level, chroma, hue and lightness for the fabric according to the invention (UHV F/Y) and for the commercially available alternatives used above and a natural white tennis ball felt is given in Table 1 below.

Table 1

Product	**Peak Reflectance Level**	**Chroma (Saturation)**	**Hue**	**Lightness**
Natural White Tennis Ball Felt	78.46	8.9	92.4	87.8
Milliken Standard Yellow Felt (Std.F/Y)	122.4	98.2	108.8	96.5
Milliken High Visibility Yellow felt (Hi.Viz.F/Y)	119.8	112.0	101.3	94.2
UHV F/Y	129.9	113.4	104.7	97.9
Tretorn TXT Ball	113.1	100.9	104.5	93.6
Pro Penn Ball	124.4	95.8	108.1	95.7

Thus, the UHV F/Y felt of this invention can be used for the manufacture of yellow tennis balls of improved colour properties, which is obviously highly desirable to tennis players. Such improved properties permit, during a game, a more easy and rapid catch (visualisation) of the incoming moving ball by the tennis player and thus a quicker reaction and positioning of the player with respect the ball.

The method and the product thus produced according to the invention may be used for other purposes than covering tennis balls. The high visibility of colour material of the invention could also be used for producing other items than tennis balls, especially those where high visibility is important (for example footballs - especially for indoor use - basketballs and volleyballs).

Alternative dyeing technologies may be used, and specific mention may be made of the following:

1. Winch beck

Winch beck dyeing is an alternative technology for dyeing piece goods and pre-dates the Softflow jet-dyeing apparatus. Whilst the dyeing method is essentially the same as for jet-dyeing the liquor ratio would be higher, normally 20:1 to 25:1.

In simple terms, this is a vertical stainless steel tank; the top half of one side lifts up and down for

access and the top is vented. A large roller known as a winch is contained within the top section. There is a heating coil in the bottom section.

The tank is partially filled with water and the cloth is then passed over the winch roller, through the water and then back out of the machine. The two ends of the cloth are sewn together to make an endless rope. The winch is driven to continually rotate the rope through the water.

Dyes and chemicals are pre-dissolved and then added to the water. Steam is passed through the heating coil to raise the bath temperature to 98°C. This temperature is held for 30-45 minutes, after which the tank is cooled by filling with cold water and then draining. This is repeated until a safe handling temperature is achieved after which the cloth is removed.

Products used in the bath:

Fluorescent yellow dyestuff - colouring material.
Glauber salts - acts as a levelling agent.
Formic acid - to lower the pH making the cloth more attractive to dyestuff.

2. Loose stock machine

This is a circular stainless steel tank (or vat), from 1 metre to 3 metres diameter, which is partially

filled with water. The material, in the form of loose wool and/or nylon fibres, which have been pre-washed is loaded into a cage. This cage then has a lid attached and is placed inside the outer tank. Dyestuff and chemicals are pre-dissolved inside a header tank and then pumped into the tank and through the stock in the cage.

The temperature of the vat is raised to 98°C and held for 30-45 minutes. The dye liquor is drained and fresh cold water pumped through to rinse and cool the loose stock.

The products used are the same as for winch dyeing.

After dyeing the fibres are processed into fabric form.

3. Package dyeing

Yarn is wound onto a stainless-steel cylinder which is perforated, allowing the dyeing liquor to be pumped through the yarn package from inside to out and vice versa. The yarn package is loaded into a circular, stainless steel tank and then pre-dissolved dyes and chemicals are pumped in.

The temperature of the liquor is raised to 98°C by a steam heating coil. This temperature is maintained for approximately 1 hour. The packages are then rinsed with cool water to cool the bath and remove

residual dyestuff. The batch is left to drain and then removed from the vessel.

Products used are the same as for winch dyeing.

Claims :

1. A method of dyeing a fabric material, said material being a woven felt which comprises warp and weft yarns, said method comprising the step of contacting said woven felt with a bleaching agent prior to or simultaneously with a fluorescent dye providing said colour.

2. The method as claimed in Claim 1, wherein the dyestuff is a yellow dye.

3. The method as claimed in either Claim 1 or 2, wherein said yellow dye has a colour index number acid yellow 250.

4. The method as claimed in any one of Claims 1 to 3, wherein said material is made from a mixture of fibres of different types.

5. The method as claimed in any one of Claims 1 to 4, wherein said material comprises a mixture of wool and synthetic fibres.

6. The method as claimed in Claim 5, wherein said synthetic fibres are polyamide fibres.

7. The method as claimed in Claim 6, wherein said polyamide fibres are Nylon 6,6 fibres.

8. The method as claimed in any one of Claims 1 to 7, wherein the content of wool fibres in said material is at least 20% by weight.

9. The method as claimed in any one of Claims 1 to 8, wherein the content of wool fibres in said material is at least 25% by weight.

10. The method as claimed in any one of Claims 1 to 9, wherein the content of wool fibres in said material is at least 40% by weight.

11. The method as claimed in any one of Claims 1 to 10, wherein said weft yarns comprise at least 20% by weight of wool.

12. The method as claimed in any one of Claims 1 to 10, wherein said weft yarns comprise at least 30% by weight of wool.

13. The method as claimed in any one of Claims 1 to 10, wherein said weft yarns comprise at least 40% by weight of wool.

14. The method as claimed in any one of Claims 1 to 13, wherein said material is processed in piece form.

15. The method as claimed in any one of Claims 1 to 14, wherein said material is contacted with a partitioning agent.

16. The method as claimed in Claim 15, wherein said partitioning agent is an alkylarylsulphonate in water and comprises 50-60% by weight of the salt of dodecylbenzenesulphonic and triethanolamine.

17. The method as claimed in any one of Claims 1 to 16, wherein said material is treated using a jet-dyeing apparatus.

18. The method as claimed in Claim 17, wherein a liquor ratio of from 6:1 to 8:1 is used to run said jet-dyeing apparatus.

19. The method as claimed in Claim 15, wherein the pH of the liquor is of from 4.2 to 4.5.

20. The method as claimed in any one of Claims 1 to 19, wherein said material is contacted with the bleaching agent prior to said material being contacted with said fluorescent dye.

21. The method as claimed in any one of Claims 15 to 16, wherein said material is contacted with the partitioning agent prior to said material being contacted with said fluorescent dye.

22. The method as claimed in any one of Claims 15, 16 and 18, wherein said bleaching agent is added simultaneously or quasi-simultaneously with the partitioning agent.

23. The method as claimed in any one of Claims 1 to 22, wherein said bleaching agent is an inorganic reducing agent with chelating agents and comprises 30-40% by weight tetrasodium ethylene-diaminetetraacetate and 30-40% by weight disodium disulphite.

24. A coloured fabric material obtainable according to the method described in any one of Claims 1 to 23.

25. The use of a dyed fabric material as claimed in Claim 24 for the manufacture of a sports ball.

26. The use claimed in Claim 25, wherein said sports ball is a tennis ball.

27. A coloured (non-white) fabric material suitable for use in sports ball manufacture, said material being a woven felt which comprises warp and weft yarns, wherein said material includes wool fibres and exhibits the following characteristics:

i) a chroma value of 100 or more;

ii) a lightness value of 95 or more; and

iii) a reflectance value of 120 or more.

28. The fabric material of Claim 27, wherein said chroma value is 105 or more.

29. The fabric material as claimed in either one of Claims 27 and 28, wherein said lightness value is 96 or more.

30. The fabric material as claimed in any one of Claims 27 to 29, wherein said reflectance value is 125 or more.

31. The fabric material as claimed in any one of Claims 27 to 29, which exhibits the following characteristics:

i) a chroma value of 110 or more;
ii) a lightness value of 97 or more; and
iii) a reflectance value of 128 or more.

32. A white fabric material suitable for use in sports ball manufacture, said material being a woven felt which comprises warp and weft yarns, wherein said material includes wool fibres and exhibits the following characteristics:

i) a chroma value of 14 or less;
ii) a lightness value of 85 or more; and
iii) a reflectance value of 100 or more.

33. A white fabric material as claimed in Claim 32, wherein said chroma value is 8 or lower.

34. A white fabric material as claimed in either one of Claims 32 and 33, having a lightness value of 92 or greater.

35. A white fabric material as claimed in any one of Claims 32 to 34, having a reflectance value of 85 or more.

36. A white fabric material as claimed in any one of Claims 32 to 35, which exhibits the following characteristics:

i) a chroma value of 5 or less;

ii) a lightness value of 93 or more; and

iii) a reflectance value of 90 or more.

37. A fabric material as claimed in any one of Claims 27 to 36, wherein said material is made of a mixture of fibres of different types.

38. A fabric material as claimed in any one of Claims 27 to 37, wherein said material comprises a mixture of wool and synthetic fibres.

39. A fabric material as claimed in Claim 38, wherein said synthetic fibres are polyamide fibres.

40. A fabric material as claimed in Claim 39, wherein said polyamide fibres are Nylon 6,6 fibres.

41. A fabric material as claimed in any one of Claims 27 to 44, wherein the content of wool

fibres in said material is at least 20% by weight.

42. A fabric material as claimed in any one of Claims 27 to 41, wherein the content of wool fibres in said material is at least 40% by weight.

43. A fabric material as claimed in any one of Claims 27 to 42, wherein said weft yarns comprise at least 20% by weight of wool.

44. A fabric material as claimed in any one of Claims 27 to 43, wherein said weft yarns comprise at least 30% by weight of wool.

45. A fabric material as claimed in any one of Claims 27 to 44, wherein said weft yarns comprise at least 40% by weight of wool.

46. A sports ball having a fabric material outer surface, said fabric material being a fabric material as defined in any one of Claims 27 to 45.

47. A sports ball as claimed in Claim 46 which is a tennis ball.

48. A sports ball having a fabric material outer surface, said fabric material being a fabric material as obtained by the method of any one of Claims 1 to 24.

49. A sports ball as claimed in Claim 48 which is a tennis ball.

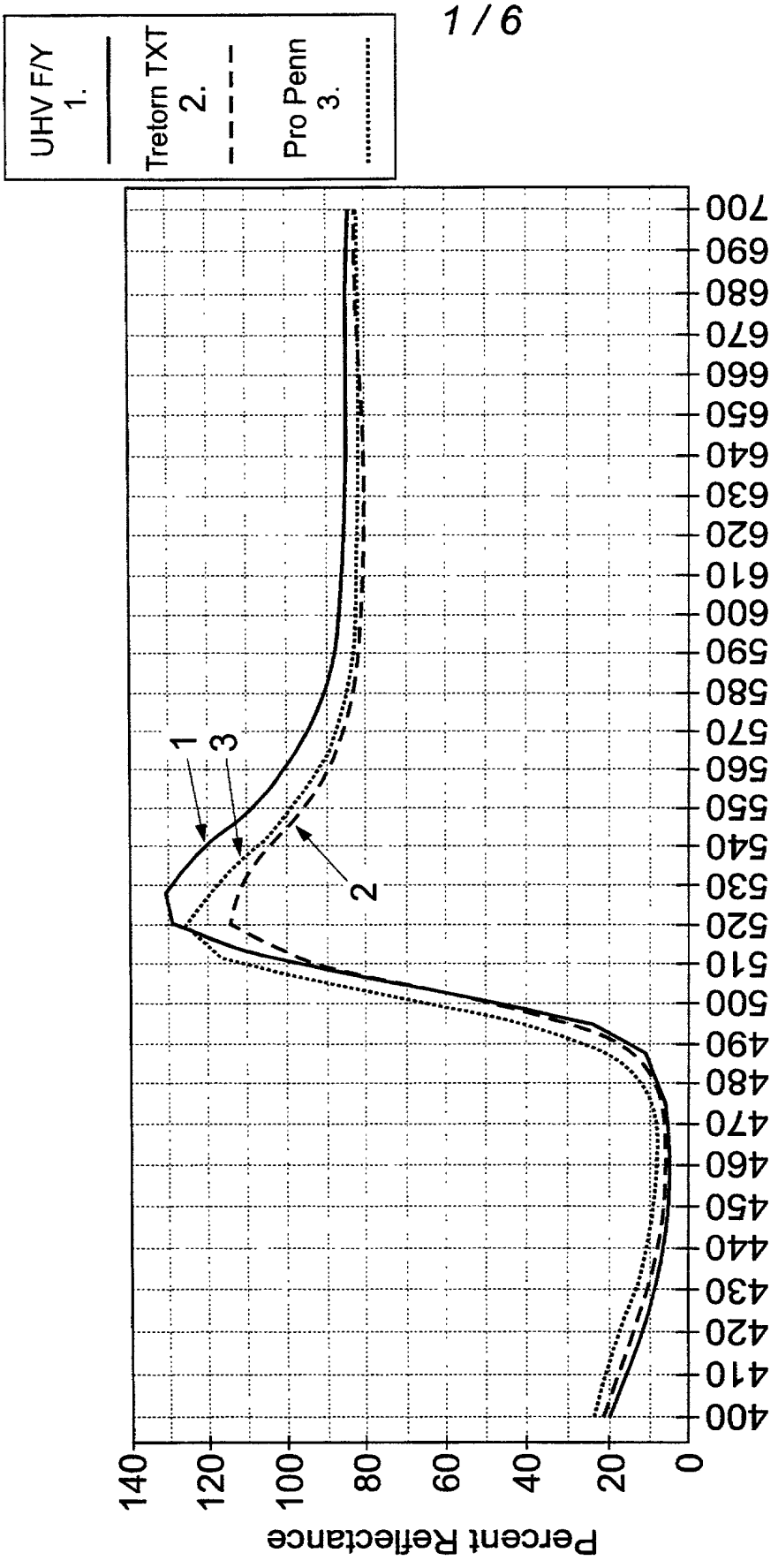
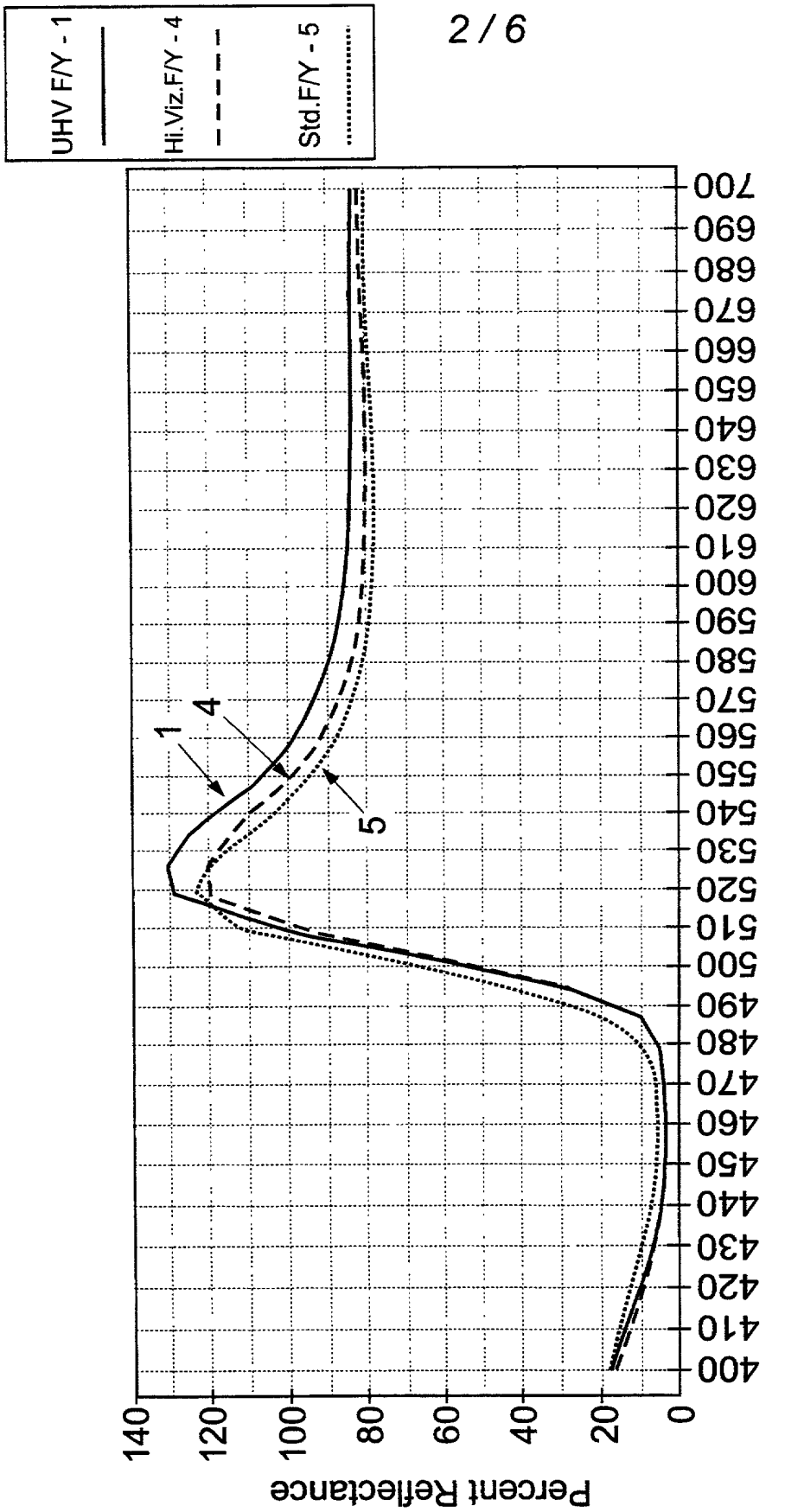


Fig. 1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140
Wavelength (NM)
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430
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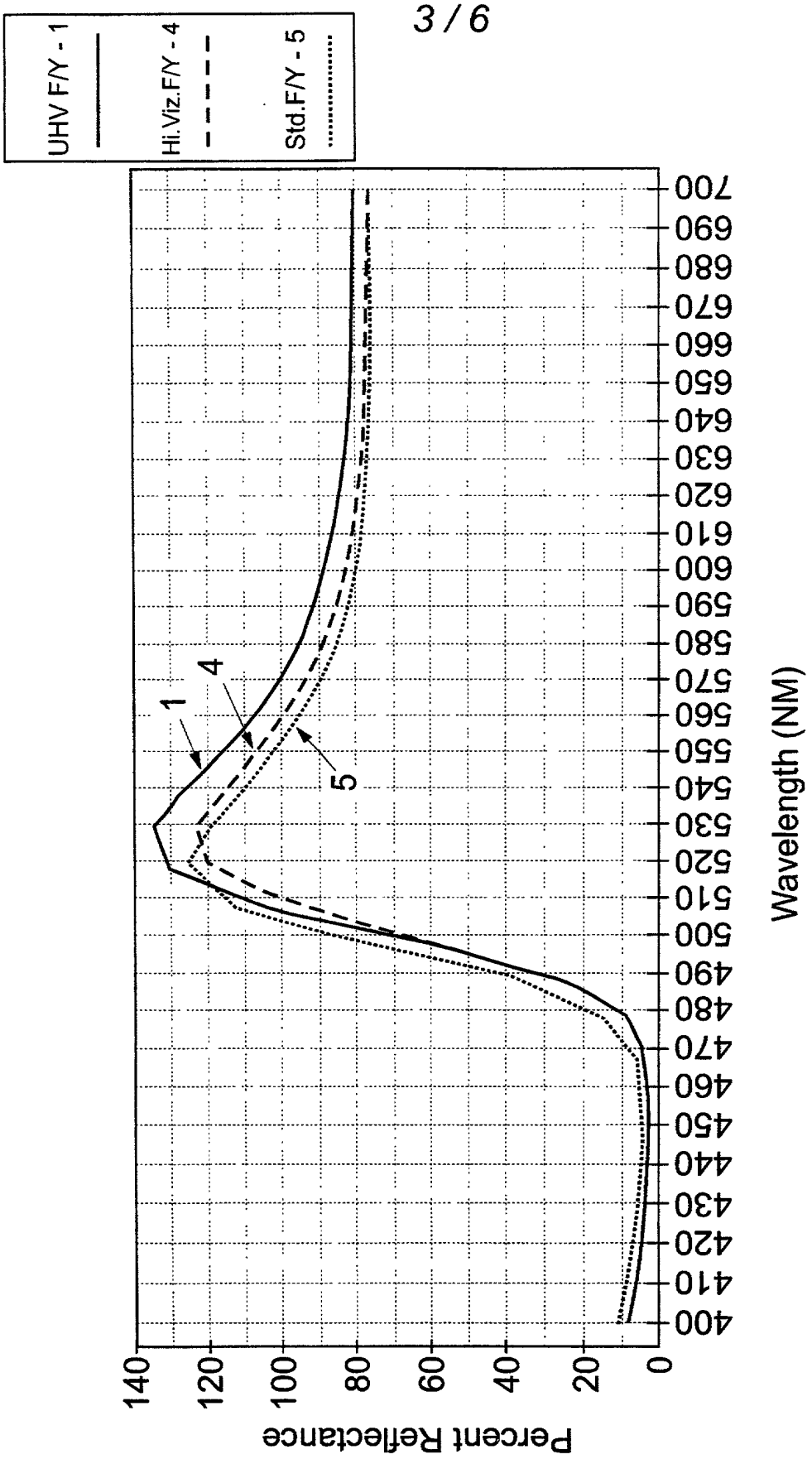
Fig. 2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100
120
140
Wavelength (NM)
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420
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690
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Fig. 3

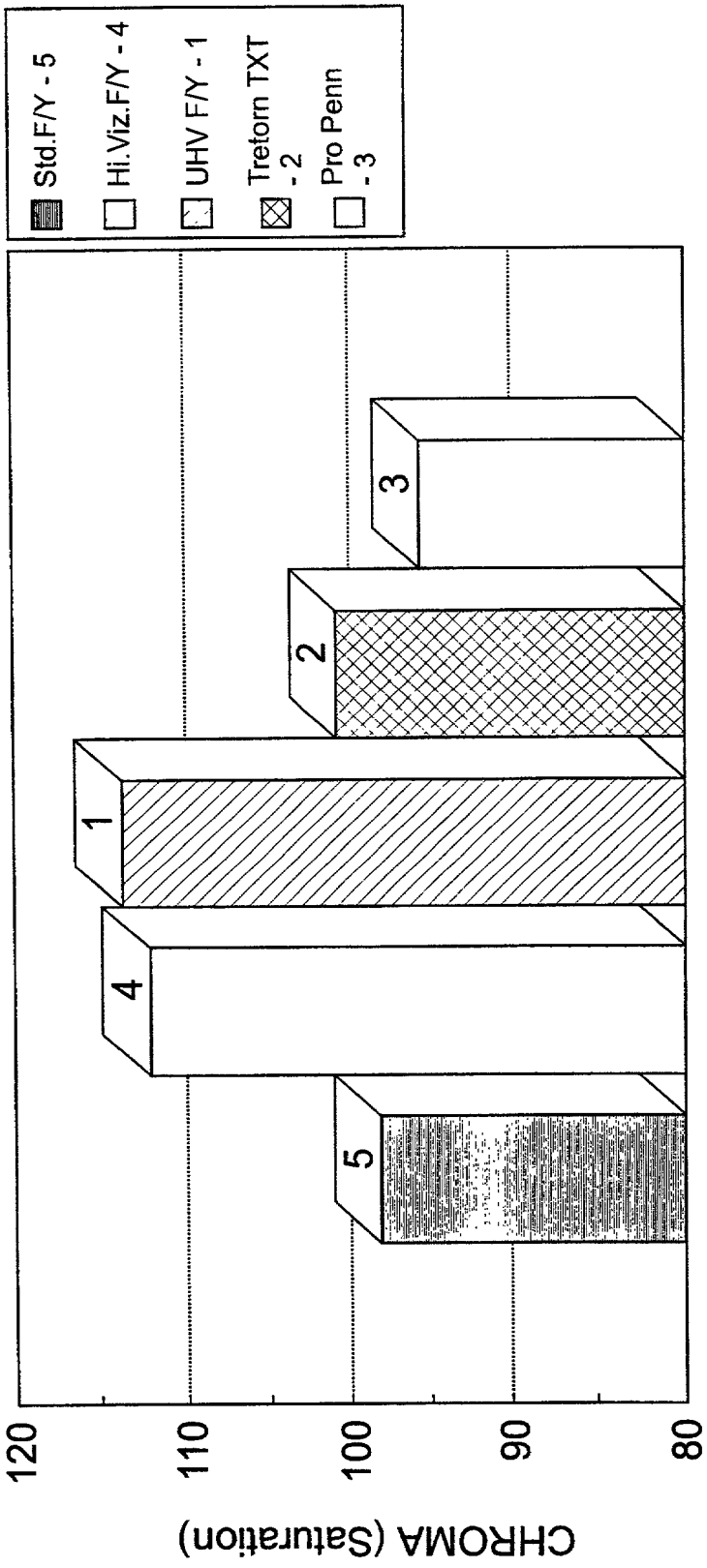
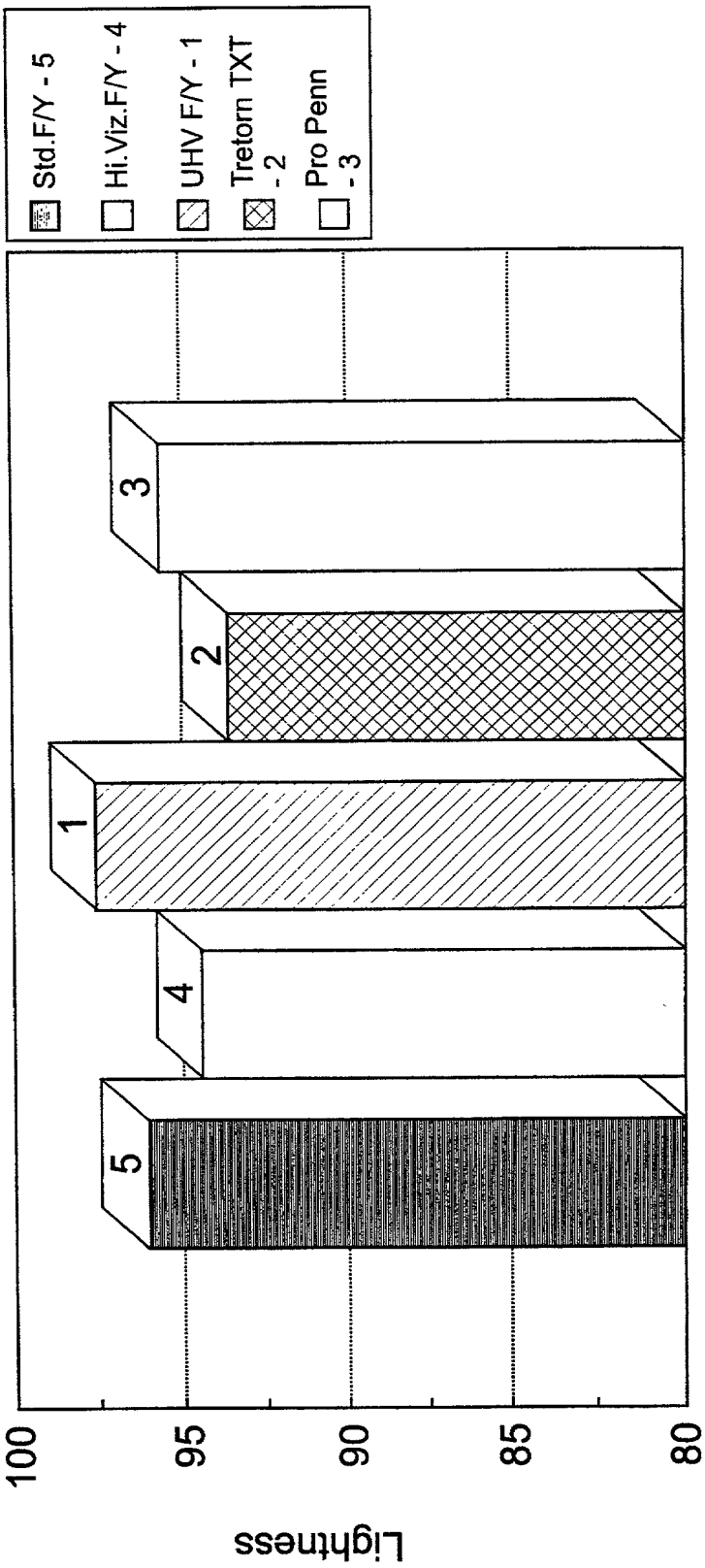


Fig. 4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Hi.Viz.F/Y - 4
UHV F/Y - 1
Tretorn TXT - 2
Pro Penn - 3
1
2
3
4
5
100
95
90
85
80
Lightness

Fig. 5

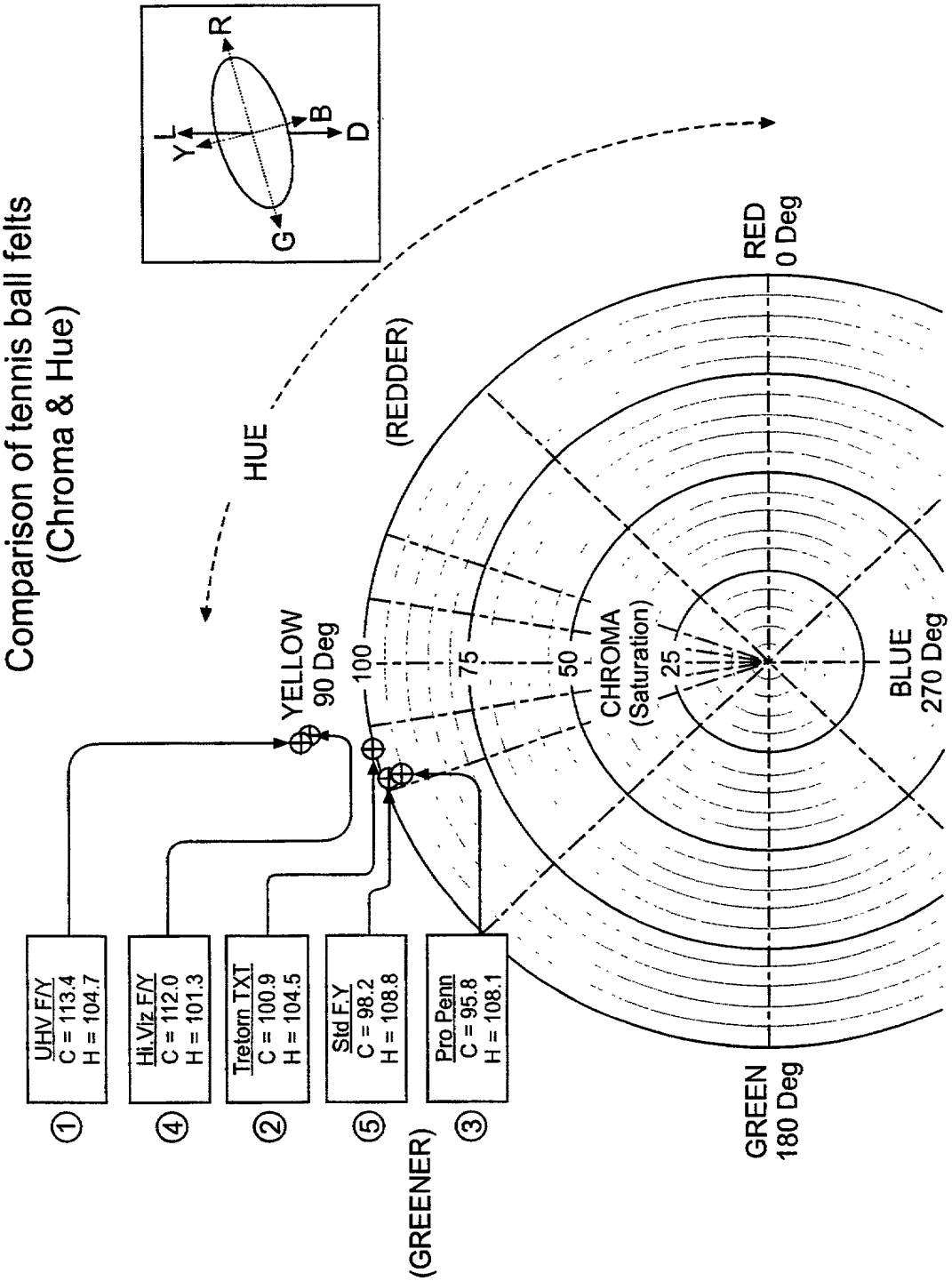
Comparison of tennis ball felts
(Chroma & Hue)
R
Y
L
B
D
G
HUE
(REDDER)
RED
0 Deg
YELLOW
90 Deg
100
75
50
CHROMA
(Saturation)
25
BLUE
270 Deg
GREEN
180 Deg
(GREENER)
UHV F/Y
C = 113.4
H = 104.7
①
Hi.Viz F/Y
C = 112.0
H = 101.3
④
Tretorn TXT
C = 100.9
H = 104.5
②
Std F.Y
C = 98.2
H = 108.8
⑤
Pro Penn
C = 95.8
H = 108.1
③

Fig. 6

United States Patent Application

COMBINED DECLARATION AND POWER OF ATTORNEY

Attorney's Docket Number MUR-858215

As a below named inventors I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled:

"Dyed Fabric Material, Method of Producing the Same and Use of the Fabric Material in the Manufacture of Sports Balls"

the specification of which:

[c] was filed as a PCT International Application Number PCT/GB00/02290 on 23 June 2000.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Paul F Prestia	Reg No 23,031	Christopher R Lewis	Reg No 36,201
Allan Ratner	Reg No 19,717	Louis W Beardell Jr	Reg No 40,506
Andrew L Ney	Reg No 20,300	Rocco L Adomato	Reg No 40,480
Kenneth N Nigon	Reg No 31,549	Jacques L Etkowicz	Reg No 41,738
Kevin R Casey	Reg No 32,117	Eric A Dichter	Reg No 41,708
Benjamin E Leace	Reg No 33,412	Mark J Marcelli	Reg No 38,593
James C Simmons	Reg No 24,842	Joshua L Cohen	Reg No 38,040
Lawrence E Ashery	Reg No 34,515	Christopher J Dervishian	Reg No 42,480
Robert L Anderson	Reg No 25,771	Jack J Jankovitz	Reg No 42,690

Send correspondence to:

RATNER & PRESTIA
Suite 301, One Westlakes,
Berwyn, P O Box 980,
Valley Forge, PA 19482-0980

Telephone calls: Allan Ratner (610) 407 0700

I acknowledge the duty to disclose information which is material to the examination of this Application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119 of any foreign Application(s) for Patent or inventor's certificate or of any PCT International Application(s) designating at least one country other than the United States of America listed below, and have also identified below any foreign Applications for Patent or inventor's certificate or any PCT International Application(s) designating at least one country other than the United States of America filed by me on the same subject matter and having a filing date before that of the Application(s) of which priority is claimed:

COUNTRY	APPLICATION NUMBER	DATE OF FILING	PRIORITY CLAIMED
United Kingdom	9914510.4	23 June 1999	Yes
United Kingdom	0009783.2	20 April 2000	Yes
United Kingdom	0011752.3	17 May 2000	Yes

FIRST INVENTOR

Full Name : BRASIER, Alan John
Residence: Gloucestershire, United Kingdom GBX
Citizenship: British (Great Britain)
Post Office Address: 53 Swallowcroft, Eastington, Stonehouse, Gloucestershire, GL10 3BH, United Kingdom

SECOND INVENTOR

Full Name: SMITH, David Anthony
Residence: Gloucestershire, United Kingdom GBX
Citizenship: British (Great Britain)
Post Office Address: Mayflower Lodge, Colethrop, Haresfield, Nr Stonehouse, Gloucestershire, GL10 3EJ, United Kingdom

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on the information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such wilful false statements may jeopardize the validity of the Application or any Patent issuing thereon.

Signature of First Inventor X [signature] Date X 13. December 2001.

Signature of Second Inventor X [signature] Date X 13. December 2001